

WHAT IS CLAIMED IS:

1. A method of producing hydrogen from solid carbon materials and feed water, comprising the steps of:

5 preparing an arc plasma reactor having a plasma reactor chamber and arc discharge electrodes located in the reactor chamber;

supplying solid carbon materials into the reactor chamber to form a large number of minute arc passages in the solid carbon materials;

10 supplying electric power to the arc discharge electrodes to produce arc discharge plasmas in the minute arc passages, respectively; and

passing steam through the minute arc passages to cause the steam to react with the solid carbon materials under the presence of the arc discharge plasmas to produce hydrogen rich gas.

15 2. The method of claim 1, wherein the thermal plasma reactor has an upstream side formed with a steam generating zone and a downstream side formed with a hydrogen rich gas generating zone, and further comprising the steps of:

supplying feed water into the steam generating zone of the arc plasma reactor to form the steam at the upstream side thereof;

20 reacting the steam with the solid carbon materials in the hydrogen generating zone in the presence of the arc discharge plasmas to generate the hydrogen rich gas;

cooling the hydrogen rich gas to separate condensed water; and

25 recycling the condensed water into the steam generating zone to be converted into the steam.

3. The method of claim 2, further comprising the steps of:

separating impurities containing CO and CO₂ from the hydrogen rich gas.

4. A hydrogen production system comprising:

30 an arc plasma reactor having a solid carbon supply port, a feed water supply port, an insulating casing formed with a synthesis gas outlet, an arc plasma chamber formed in the insulating casing, alternating current arc discharge electrodes located in one end of the arc plasma chamber, a neutral electrode located in the other end of the arc plasma chamber,

and a plurality of minute arc passages formed in solid carbon materials filled in the arc plasma chamber;

a feed water supply pump for supplying feed water into the arc plasma chamber via the feed water supply port to cause the feed water to be converted into steam; and

5 an alternating current power supply for supplying alternating current electric power to the arc discharge electrodes to cause arc discharge plasmas to be generated in the minute arc passages, respectively, such that the water is exposed to the arc discharge plasmas to form the steam which reacts with the solid carbon materials in the presence of the arc discharge plasmas during passing through the minute arc passages to produce hydrogen rich gas.

10 5. The hydrogen production system of claim 4, further comprising:

a liquid/gas separator unit coupled to the arc plasma reactor for separating the hydrogen rich gas and condensed water from one another; and

15 a recycle line for recycling the condensed water to the arc plasma reactor to form the hydrogen rich gas therein.